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EDITORIAL

Joseph Priestley

WE are interested to note that The Priestley Club of Leeds proposes to celebrate the two hundredth anniversary of the birth of Joseph Priestley by a lecture entitled "The Discovery of Gases, and its Significance" to be delivered by Prof. Irvine Masson in Leeds on Monday the 13th March next. This lecture, to which all who are interested will be welcome, will provide an interesting celebration of a singular and able man who added greatly to our knowledge of chemistry. Professor Masson has himself studied the history of the early periods of chemical history and written lucidly and pleasantly about them and Leeds is fortunate in having as lecturer on this occasion one who is so specially qualified to interest a chemical audience. We do not propose to dilate on the merits of Priestley as a chemist; we can safely leave his reputation in the hands of Professor Masson; but it is interesting to compare his professional training with that of the chemist in this country in the twentieth century. Priestley began his training by the study of Hebrew, Chaldee, Syriac, Arabic, and Natural Philosophy, and no doubt he studied theology very carefully for he wrote religious and other books so early as the year 1761 when he was twenty-eight years old. He studied also Latin and Greek, electricity, and astronomy, and seems to have read very widely on a great variety of subjects and to have written profusely and argumentatively especially in connexion with religious matters. The modern chemist must be able to read chemistry and mathematics in French and German but no other knowledge of languages is required. Priestley must have learned all the chemistry that was then known by others in the course of a few months or still fewer years. Now a chemist must study his science very assiduously during the bulk of his time for three, or four, or five years before he can obtain a suitable degree and so obtain a post worthy of so learned a man. He must continue to study his science for many more years if he is to retain his post and continue to be efficient in his work. Priestley had abundant time that he employed in polemical and other writing. Some modern and some less modern chemists write a great deal, but other modern chemists sometimes write as if the art were not perfectly easy and familiar to them. These great differences are explained by the enormous and rapid growth of the science of chemistry; no one now attempts to know all the important chemical facts: the most erudite make themselves acquainted with the important chemical principles and the important facts relating to one branch of chemistry; they are fortunate if they know to what men or to what books they should apply for the remaining facts. Our modern chemical training is based upon a rigid system of examinations that tend to become more and more severe. The system has been abused or criticized many times but it does not lose its hold on the public. To a certain extent the standard of the examinations seems to have been set up by the chemists themselves, or the senior members of the profession, and we are not clear that the standard is not unnecessarily high. At any rate the bicentenary of Priestley is as fitting an occasion as any other for a contemplation, not only by the chemists, of the modern training of a chemist and a consideration whether this training tends to bring out all the best qualities latent in the chemist. So far as mere study is concerned it seems to us that the chemist devotes more time to this than do those engaged in other professions; meaning by this the study of books and the lab. as opposed to the excellence that is derived from long experience and a knowledge of human nature. So far as the latter is concerned we should not advise anyone to copy the example of Priestley.

White and Shining

The hot springs of Tuscany, the brines of Searles Lake in California, the bedded deposits of razorite in California, the dried lakes of Tibet, pandermite from the coast of the Sea of Marmora are some of the sources from which the world draws its supply of borates, a chemical which has many more uses in the arts and manufactures than would at first sight be expected.

The United Kingdom has none of it, and the Empire likewise lacks it in commercial quantity, so that we are constrained to import crude boron materials and concentrates of boracite "duty free." The Moslem chemists knew the use of borax as a flux, and *tincal* has been coming from Tibet since 1653: for a time in the Middle Ages Venice was the centre of its purification. As is well known, boron, the element, though in an impure state, was first prepared by Davy: even to-day our knowledge of its properties is not very precise. The Imperial Institute has just issued a pamphlet, published by the Stationery Office, to be obtained for a modest 9d., in which all there is to know about borates is included, their preparation and their uses, their production and prices, with statistics galore, each producing country being dealt with separately. There are several borax minerals which are either sodium borates, differing in degree of hydration, or hydrated calcium borates. Boric acid is of volcanic origin, as witnessed by its presence to-day in hot springs in volcanic regions or in the vents of steam from the fumeroles with which our Italian honorary member, Prince Ginori Conti, has from time to time made us so well acquainted, both in picture and by word of mouth. The bedded deposits are consequently regarded as limestones in which boric acid has replaced carbon dioxide: the soluble borates have accumulated in lakes which through evaporation have either become dry or are in process of doing so. Borax and boric acid, like many another material, tell the same story, of extended use due to substantial reductions in price and to research work aimed at finding new uses for them, which is becoming a commonplace in the chemical industry. As elsewhere, its trial has led to the discovery of new and improved materials. Thus, as a flux in enamels, in glass, and in pottery it has more than proved itself, as for example in glass of the pyrex type containing high proportions of silica. How should we carry on the laundry without boron compounds, though the housewife is probably unaware that this element is in her "copper" or its modern equivalent? White and shining is the translation of the Arabic name for borax: it might well describe linen after a perborate bleach, though it was actually first applied to substances used as fluxes. There was a time when boric acid was widely used as a preservative and might have been said to appear on every breakfast table. The bureaucrats knew better, however; they arraigned it as harmful and, having convicted it on what many hold to be a minimum of evidence, have invoked the law to regulate and suppress it. So it has gone from the menu, and with it also the cream which accompanied it, though it is now, we learn, being used in increasing quantities for preserving lemons, which are dipped in it for a few minutes after gathering, against attack by moulds. Very minute quantities of boron compounds seem to be essential to plant growth, though this appears to be true of so many elements nowadays. Enough has been said to show *per contra* the deficiencies and miseries which would confront us in a boron-less world. No doubt among our readers there are some who are determined to add to its utility, and so to our miseries when some war of the future deprives us of it.

SOME PROBLEMS OF THE CHEMIST IN THE FLOUR INDUSTRY

By A. J. HAMMER

Flour is one of the most difficult substances with which the chemist has to deal in view of the problem of predicting with any reasonable degree of assurance just how the product will behave in the hands of the consumer. He has at his disposal a number of analytical procedures which, although they are of considerable assistance to him in evaluating a sample, do not give him sufficient information to make a definite statement as to the performance of the product in the bakery.

The three standards used in the average analytical control laboratory are protein, ash, and moisture. The percentage of protein is perhaps the most important of these analyses but this gives only an indirect evidence of the baking strength of the flour. A low grade flour will usually show low baking strength although having a large amount of gluten or protein.[1] The percentage of ash although not of as much importance to the baker as it is to the miller gives some indication as to the quality of the flour. To the miller however, it is an indication of the efficiency and cleanliness of his mill. When the ash analysis of a run of a particular grade of flour takes a sudden increase the miller knows immediately that something has gone wrong in his mill. The control of the moisture content of the wheat as it goes to the mill and the moisture content of the flour are of considerable importance. There is a certain moisture percentage below which the wheat will not mill efficiently. The wheat grain, when too dry, will be more or less brittle as it goes to the rolls, and the bran instead of being flaky will be broken up into finer particles. A large part of the unsoundness of flour comes from excess moisture at some stage in the history of the wheat or the flour made from it.[2] An increase in the moisture content of flour during milling may also be a means of additional revenue to the miller, providing the percentage remains within certain limits. This comes about when the wheat is unusually dry and a large amount of water must be added to the wheat to bring it to the correct moisture content for milling. A mill producing 10,000 barrels of flour per day can increase its daily profit some $500 by adding 2% to the moisture content of the flour.

The baker usually requires a definite percentage of water in the dough to make it ready for the fermentation process. This necessitates a knowledge of the moisture content of the flour but he cannot always depend upon the value given by the producer. Flour, like any similar product, will lose moisture when stored in a dry warehouse, and the baker must depend upon his own absorption test to determine the amount of water needed. This test is usually made by adding measured volumes of water to a weighed sample of flour until the resulting dough reaches a certain consistency, determined by testing the stickiness of the dough either with the fingers or a piece of glass. Cereal chemists have adopted a method which has been more or less standardized for this determination.[3]

The importance of the absorption determination has been stated by Harrel.[4] He has found this to be one of the most vital factors in bread production, having a

direct influence on both the volume and quality of the loaf. An increase in loaf volume of 750 c.c. was produced by an increase of absorption from 50% to 65% whilst an absorption of 75% produced a decrease in loaf volume of 600 c.c. It is only within comparatively recent years that the chemist has been able to show the miller that he can be of service to him in producing a better and more uniform product. This is probably due to the fact that the milling industry has been a trade in which the operator grew up with the business after serving an apprenticeship under the direction of the head miller. Consequently the millers have been slow to adopt scientific methods, and methods in use to-day are basically the same as those used a half a century ago.

The miller's method of judging a flour is by the use of the "slick," which is a polished piece of metal similar to a wide spatula. This is used to produce a smooth surface on a sample of flour held in the hand, or he may prepare a flour slick on a piece of glass by submerging in water and allowing to dry. When compared with a slick produced in a similar manner from a "standard" flour this gives him an indication of the crumb colour of the bread which will be made from it. These tests also give him information concerning the "dress," granulation, freedom from sharps, fine bran particles, etc. of the flour. If the miller knows his mill thoroughly he can make some uncanny predictions as to the ash content of a sample by the use of the dry slick. Also if he knows the protein analysis of the wheat coming into his mill he can make a close estimate of the protein content of the finished flour since for a particular crop there is a definite relationship between the protein of the wheat and the flour made from it.

In addition to the protein, ash, and moisture analyses, the chemist has at his disposal a number of other determinations, the advisability of the use of which varies with the individual. Within the past few years there have appeared a number of papers on the use of viscosimeters in the prediction of the baking qualities of flours. Two methods have been described, one in which the viscosity of a flour suspension in water is determined[5] and the other in which the viscosity of a dough prepared under prescribed conditions is determined. Attempts have been made to correlate viscosity and swelling power with baking properties by determining the viscosity in the presence of regularly increasing quantities of acid. When the difference in viscosity is plotted in the form of a curve, rough estimates may be made of the ash and gluten content.[6]

One of the chemical methods of evaluation of flour which has proved of considerable value is the determination of the diastatic activity or gassing power. In this the rate of evolution of carbon dioxide from a dough made according to a fixed formula[7] is measured but a more accurate method has been devised in which the amount of maltose produced during the fermentation at a definite temperature and for a definite length of time is determined. The American Association of Cereal Chemists has defined the unit of diastatic power as the number of milligrams of maltose produced by ten grams of flour under certain specified conditions. The number of units for a satisfactory flour is considered to be about 200.

There are several factors which influence the diastatic power of a flour, four of which will be mentioned: (*a*) The age of the flour, that stored for a considerable length of time being found to show a decrease in diastatic power. (*b*) The amount of precipitation during the growth of the wheat; wheat grown during particularly dry years has a marked deficiency in diastatic power. (*c*) The fineness of the flour. It has been shown by Johnson[8] that the diastatic power of a flour increases with the degree of fineness to which it is ground. (*d*) The method of harvesting the wheat. This is perhaps the most important factor and is attracting considerable attention to-day. Wheat cut with a binder and shocked is usually much higher in diastatic power than "combine" wheat, due to incipient germination in the shock.

A flour deficient in diastatic power produces bread of an inferior quality unless an excess of sugar is added to the dough. The volume of the loaf from a flour weak in diastatic power is often quite small and the "bloom" or crust colour is very pale, even though the flour has a high gluten content. Bakers often use a diastatic malt extract to improve the bread made from such flours, but an excess of this material often causes a decrease in the quality of the texture and crumb colour. Millers have used sprouted wheat to improve these flours and some remarkable results have been obtained. Sprouted wheat is however not always available, and the cost of equipping a mill with facilities for sprouting the amount of wheat necessary is prohibitive. If the miller were sure that all of his wheat would be low in diastatic power it might pay him to make this investment, but he would probably not have use for the sprouting equipment more than once in four or five years.

All of the above determinations are of value but the baker is interested more in the baking strength of the flour than in the chemical analysis. The term "baking strength" however includes several factors which must be determined by chemical means. Briggs[1] has defined baking strength as that unique characteristic of wheat flours by reason of which, in varying degrees, they are capable, when fermented with yeast, of yielding large, light, spongy, evenly cellular doughs which, when baked, retain the same light structural character. In other words the baking strength of a flour is that property by which it is able to produce a good loaf of bread. Cereal chemists have adopted the baking test as the most satisfactory single test to which a flour may be subjected in order to determine its probable value to the trade. A flour which produces a satisfactory loaf of bread in the laboratory may not however give the same results in the bakery. Great variations in the formulæ used, and in fermentation time and temperatures, baking temperatures, etc. may produce loaves of bread which cannot be recognized as being made from the same flour.

In order to standardize a method of baking, cereal chemists have adopted a procedure based on the principles and technique described by Werner and later accepted as the standard baking procedure.[9] In this an effort has been made to eliminate all variables with the exception of the flour. Such variable factors as temperature and humidity during fermentation,

baking temperature, time and method of mixing the dough, and the temperature of the dough as it is ready for the fermentation process are accurately controlled. The dimensions of the baking pan and the mixing and fermentation bowls are standardized and a definite baking formula is used in which the percentage of water is always the same regardless of absorption by the flour. This method enables a technician with even a very limited amount of experience to duplicate his results within 1·6% on loaf weights and 4·5% on loaf volumes.

Varying one factor at a time, this method may be of use in determining the best formula and baking conditions to be used with any particular flour. The accompanying diagram (Fig. 1), compiled from the results of some baking tests carried out by the writer, illustrates the determination of fermentation tolerance of two flours of different grades. These curves were obtained by plotting the fermentation time against the loaf volumes. Curve A shows that this flour will produce a fairly satisfactory loaf when fermented between 120 and 225 minutes. This indicates that the flour would be satisfactory for home use where the conditions under which the fermentation takes place are not accurately controlled. The general appearance of the loaves, crumb colour, and texture showed however considerable variation, those between 165 and 225 minutes being the most satisfactory. Curve B shows the results obtained with a flour with a higher protein content. The absence of a plateau and a much greater volume under optimum conditions shows that this flour is better adapted for use in a bakery where the

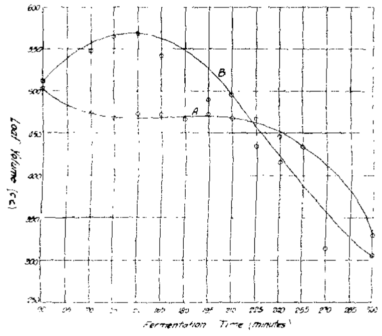

FIG. 1

Variation in loaf volume produced by a variation in fermentation time

fermentation time may be controlled. This flour gave the most satisfactory loaves between 150 and 195 minutes of fermentation.

In connexion with this procedure the chemist has made use of a number of chemicals with which he has been able to improve the baking qualities of a flour[10] and to predict the amount of abuse a flour will stand in the bakery. Fig. 2 shows the effect of potassium bromate on the loaf volume. Some flours, as illustrated by curve A, which was plotted from experimental data, will stand considerable potassium bromate before breaking down, although they show little or no improvement in loaf

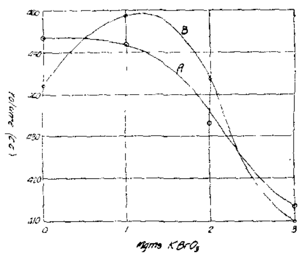

FIG. 2

Variation in loaf volume produced by additions of potassium bromate

volume from its use. Curve B has not been made from the results of any particular flour, but shows the general form of the curve that would be expected to result from a similar treatment of a flour with a higher protein content.

The chemical improvers now in use usually contain potassium bromate, calcium peroxide, or ammonium persulphate as the active ingredient. The oxidizing agent may be mixed with ammonium chloride calcium sulphate or some other similar compound which may act as a yeast food as well as a filler. In addition to the oxidizing action which they have on the gluten, some of these chemicals have a certain antiseptic power which kills the bacteria antagonistic to the yeast but does not harm the yeast itself.

Another important problem to the flour miller is that of bleaching. Chemical bleaching agents in use have practically eliminated the time necessary for bleaching by storage. The bleaching process involves the oxidation of the carotine of the flour by one of several chemicals such as nitrogen dioxide, benzoyl peroxide, chlorine,[11] or nitrogen trichloride. Some States in America in operating their pure food laws prohibit the sale of bleached flour.

The control of insect pests, and in particular the flour beetle, has been improved by the use of various fumigants among which are ethylene oxide, propylene oxide, carbon disulphide, vinyl chloride, and chloropicrin. Insurance regulations make it necessary to administer the inflammable substances in the form of a gaseous mixture with some inert gas such as nitrogen or carbon dioxide, and carbon tetrachloride is also used for this purpose as it can easily be mixed with the inflammable liquid. Carbon dioxide in the form of dry ice, which may be made into a slush with the fumigant and mixed with the wheat as it comes into the mill, has also proved very useful. The property of the flour of absorbing foreign odours

makes it necessary for any chemical that is used as an improver, bleaching agent, or fumigant with flour to be either odourless or sufficiently volatile to escape before the product reaches the consumer. Even slight traces of disagreeable odours are often carried through the entire baking process and are present in the finished loaf.

Although the cereal chemist has made remarkable progress toward the chemical evaluation of flour, he must still depend upon the baking test to predict the behaviour of the product in baking. It is highly desirable to develop purely chemical tests with which the chemist can analyze a sample and place a valid report in the hands of the miller without the time expenditure necessary for the baking test. It sometimes happens with the methods now in use that a consignment of flour may be well on its way to the consumer before the miller gets his report from the laboratory.

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SPECTROSCOPY AS AN AID TO COAL SEAM EXAMINATION AND IDENTIFICATION

J. O. SAMUEL, B.Sc.

Nothing rivals the spectrometer for detecting, without the necessity of chemical separation, minute quantities of metals present in any given mineral mixture.

Spectrum analysis is now being widely adopted in mineralogical laboratories as an accessory means of identification of mineral species and for investigating their chemical composition. The possibility of applying the spectrograph to the routine examination and identification of anthracite coal seams has been under investigation for a considerable time by the author, on behalf of the Emlyn Anthracite Colliery Co., Ltd. Extensive detailed work was necessary to establish the exact conditions and method of procedure so as to be amenable to every individual application. The technique was eventually standardized, the main details of which are given below.

Preparation of the Coal Ash

In view of the importance of reducing each coal seam ash to a reliable condition, on the investigation of the spectra of which depends the development of a satisfactory routine method, the following method was adopted.

A representative sample of each coal seam was taken and ground down to 90 mesh. A smaller representative sample of the latter was ignited at as low a temperature as possible to burn off all the carbon, with repeated additions of nitric acid to facilitate the burning and avoid loss of such elements as phosphorus, arsenic, tin, etc. during the heating process.

After complete burning, all the constituents in the ash were converted into sulphates by addition of sulphuric acid and then gently heated to fume off excess. The ash was next intimately mixed and ground with an exactly equal weight of spectroscopically pure ammonium sulphate (as supplied by Adam Hilger, Ltd., London) to facilitate arcing and 10 milligram portions of this mixture weighed out and pressed into pellets in a pellet forming machine.*

The ash is now in a condition for use either in the arc or spark method of excitation.

Arc Spectra

Spectroscopically pure copper or iron electrodes (H.S. brand Adam Hilger, Ltd.), mounted vertically, were used for the arc. The ash pellet was placed on the lower electrode filed flat, the upper electrode being rounded and brought nearly to touch the top of the pellet. The arc was struck by means of a third copper electrode drawn across the gap and the voltage across the arc maintained at 28 volts for the first minute and 32 volts for the second minute. The current was 3·0 amps.

The spectra were photographed for the next two minutes on a Hilger Medium Quartz Spectrograph using Ilford Panchromatic plates and no condensing lens for focussing the light on the spectrograph slit. Under these conditions the spectra can be obtained with a very good degree of reproducibility as regards intensity as a whole. Other conditions such as slit width, distance of arc to slit, and true alignment of arc and spectrograph must be kept constant. Fig. 1 shows a portion of the spectrum of a typical coal seam ash photographed on a copper arc alongside those of the pure copper and iron arcs.

Spark Spectra

The outfit supplied by Messrs. Hilger, Ltd., was used for generating the spark. This consisted of a ½-kw. transformer and auto transformer giving a secondary voltage on open circuit of 15,000 volts when supplied with 150 volts a.c. (50 cycles).

In parallel with the spark gap was placed a ½-kw. condenser of 0·0006 M.F. capacity. A self-inductance of 0·02 millihenry was inserted in series with the spark so as to eliminate "air lines" which otherwise would appear as an annoying background on the photographic plate. The spark was struck as before between copper

* Details of the method of the sulphation of a mineral ash and pressing into pellets have been previously given by S. Judd Lewis in Chemistry and Industry, March 25, 1932, pp.

electrodes set at a fixed distance apart and the emission focussed on the spectrograph slit by means of a sphero-cylindrical condensing lens. *An exposure of three minutes is necessary. Reproducibility of spectra is* excellent.

Examination of Spectra

Having made certain that reproducibility of each of 12 seams' ashes could be obtained with a fair degree of accuracy, these were next photographed in juxtaposition using both the arc and spark method under conditions

described previously. Each spectrogram was found to differ consistently in one or more of the following ways, according to the seam ash under examination: (1) The number of elements present, (2) The intensity and number of lines of certain elements present.

The total number of elements in a seam ash varied in number between 10 and 30 or more.

The more common elements found were lithium, sodium, potassium, magnesium, calcium, strontium, barium, aluminium, iron, chromium, manganese, lead, silicon, boron, arsenic, vanadium, yttrium.

The intensity and number of lines varied with the percentage of that element present in the ash and in many cases served as a guide to identifying the seam. Thus *in one case it was found that a particular seam always gave an exceedingly strong lithium line which* was always characteristic of that seam.

In practice, when any doubt arose regarding a seam to be identified, a number of spectrograms were taken of the unknown seam ash, between those of two standard seam ashes, one of which was believed to be identical to the unknown. If the latter was correct two groups of spectrograms coincided in all details but differed from the third. This method was used with considerable *success at the colliery in question on the normal seams and in disturbed ground, but was not tested beyond the* colliery boundaries.

The method, however, shows much promise and needs closer investigation over a wider area of the coalfield. Variations of seam quality in various districts and their effect on the consistency of the spectra need closer attention.

ALUM AND CURSING

By HUGH NICOL*

In Hoover and Hoover's edition of "Agricola" (De Re Metallica: London, 1912) already referred to (cf. Chem. and Ind., Nov. 25, 1932, p. 971), there is an interesting story of the papal malediction of workers in the English alum industry. This story would not by itself justify more than a suggestion to refer to the original, but an old book which has come under my notice in the library of Rothamsted Experimental Station gives some additional information about the "institute of swearing" which was invoked by the Church.

The Hoovers state that "the history of the disputes arising over the papal alum monopoly would alone fill a volume." According to the Hoovers, whose version is slightly abridged here, a large trade in alum was done between Italy and Asia Minor in the early part of the fifteenth century. Eventually, various Italians settled near Constantinople for the manufacture of alum. After the fall of Constantinople (1453) "great feeling grew up in Italy over the necessity of buying this *requisite for their dyeing establishments from the infidel, and considerable exertion was made to find other sources of supply.*"

Nothing much was done until an Italian refugee from Constantinople discovered a rock at Tolfa which appeared to be a suitable raw material. Experimental work was performed, the aid of the Pope tardily obtained, and experts were sent. They "shed tears of joy, they kneeling down three times, worshipped God, and praised His kindness in conferring such a gift on their age." The Roman alum industry thus auspiciously begun became a *papal monopoly, which was maintained* strenuously "by fair means and by excommunication, (the Pope) gradually advancing the price until the consumers had greater complaint than against the Turks."

By the middle of the fifteenth century alum was being made in Spain, Holland, and Germany, and later in England. Queen Elizabeth invited over "certain foreign chymistes and mineral masters," of whom at least one, Cornelius de Voz, was granted the privilege *of mining and digging for* "allom and copperas." The *Hoovers ascribe the first recorded alum works in this* country to Thomas Chaloner, about 1608, in Yorkshire.

George Alexander Cooke's "Topographical and Statistical Description of the County of York" (London: C. Cooke; not dated, but c. 1810) refers to Whitby as follows: "Here are three inland alum works, and six more upon the coast, which employ a great number of industrious people. A paper printed at Whitby relates that the art of preparing alum was first brought from Italy to Guisborough, in the reign of Queen Elizabeth, by Mr. Chaloner, who privately engaged some of the workmen in the Pope's alum works near Rome, which so exasperated his Holiness that he fulminated the following anathema against both the seducers and the seduced."

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The malediction is very thorough. It earned the praises of Tristram Shandy's father, who "would ofttimes affirm there was not an oath . . . which was not to be found" in it. The curse is hardly suitable—quite apart from its length—for reproducing without expurgation. Fortunately, Cooke adds the information that it was the same as the curse of Ernulphus, quoted in "Tristram Shandy," and having verified that it is to be found in that book, I leave the matter there.

In "Tristram Shandy" the oath is given in Book III, Chapter XI, both in English and in the original Latin, with some annotations. Cooke says that the curse was "perhaps the form prescribed by the Church to be used against atrocious offenders." Tristram Shandy's father said, "I defy a man to swear *out* of it."

It suggests a comment upon changing ethics, when that which was suitable to pass papal lips is not now seemly for publication at large. To such an extent apparently has the effort succeeded "To make chemists gentlemen, and gentlemen chemists."

OUR MILK MUDDLE

"Plato put the case in a nutshell when he stated that the penalty which good citizens have to pay by not taking part in civics and politics is to be ruled by bad men." SIR C. P. RÂY.

Milk! in 500 words! my editorial limit! About the measure of our English public mind—of the slight regard we have for that bottomless pit and all that therein happens—*unser Magen*—a factory wonderful beyond compare, yet little thought of by those who work in factories, indeed anywhere. In lead works alone is milk not merely provided but even forced upon the workers, to check poisoning. Milk! a fearsome fluid, the prospective victim not merely of permitted but of compulsory heating, to satisfy the ungovernable lust to kill bacteria by which onr Medical Officers of Health are slavishly overcome. Milk! we need a Hood to sing a melody in its praise; no maledictory "Song of the Shirt" but a pæan of supreme adoration. Milk! the stuff from which and of which all mammalian boys and girls are made in perfection, if only it be of right sort.

Milk! an all mysterious fluid, of which as yet we have no more than a vague understanding—so we appointed, as a Royal Commission, five brave men who knew nothing of its nature, to order its future production. Their Report* is doubtless most admirably calculated to serve commercial ends, especially the end common to all such reports, an increase of the Civil Service. As to up-to-date-ness, it is plus twenty years behind the times—counting from Gowland Hopkins, *anno* 1912—and if put in action beyond its commercial provisions will but retard progress, by handing over control to the ignorant, with the result that we shall soon be condemned to a public service of an average "skim" by great combines; numberless cattle will be tortured with tests and many condemned to slaughter, at great State expense—without the root difficulty being overcome.

Quality has meant to the Milk Commissioners only absence of dirt and bacteria—no word is said in their lengthy report of the debased standard below which it cannot fall if it come from cows and which public analysts are forced to uphold even in Court. No single constructive word is to be found in advocacy of an improvement in its food value; in fact, not a vestige of "food feeling" is apparent throughout the many pages of commissional musings. This in an age we call scientific! If we thus continue to neglect our own most immediate interests, no mere iron-works gas-holder in Germany will blow up: the whole world will be about our ears!

Stowed away in Whitehall lumber rooms
Science standeth and turneth away its face to the wall;
Dirty, cobweb-covered, maimed and set at naught †
Knowledge crieth in an attic and no man regardeth it.
O God! O Whitehall!

Samuel Butler, without doubt, would excuse such rape of his notes. To-day, we know that the quality of milk can be vastly improved by properly feeding the cow. We have good reason to believe also that if it were properly made, in the act of making it we might produce cattle so healthy that they would resist tubercular infection: their milk, of superlative value, in turn might render ns immune. At least there can be no better working hypothesis. If we had good milk, good oatmeal, and properly grown greenstuff, a very few pence a day might feed each of us well and soon make us in the main an A1 population.

The call is to chemists—to brush aside all Government authority—and to medical men, especially Medical Officers of Health, all timorous men, to set to work to find out how our cattle should, can, and shall be fed.

Uprouse ye then, ye Merrie, Merrie men,
for Chemistrie must sway!

H. E. A.

* Report of the Reorganization Commission for Milk. Ministry of Agriculture and Fisheries. pp. 228 (6d. net).

† As when preservatives were ruled out from cream, without any proof having been obtained that they were harmful.

BRITISH INDUSTRIES FAIR, OLYMPIA

The British Industries Fair opened on Monday last, February 20, at Olympia, the White City, and Birmingham, and will continue until March 3. Whether one is interested as a manufacturer or chemist, or is just one of the noble body of "consumers," it is worth a little effort to see the stage which British industry has now reached. Perhaps a little effort *is* entailed, for this year's Fair is bigger than ever before; the stand frontage extends for many miles, the floor space taken up is considerably greater than last year, and other records have been broken in this impressive assembly of exhibits.

Textiles are being exhibited at the White City and heavy engineering is represented at Birmingham, and at Olympia are to be found the products of every industry between the two. The section which deals with chemicals and allied products is on the ground floor to the right of the main entrance, and here the chemist will find the stands of many old friends. Fine chemicals and reagents are to be found on the attractive stands of A. Boake, Roberts & Co., Hopkin & Williams, Ltd.,

Albright & Wilson, Ltd., W. J. Bush & Co., Howard & Sons, and other firms; acids and other chemicals are shown on the stands of Thomas Tyrer & Co., Shawinigan, Ltd., Spencer Chapman & Messel, Ltd., and others; Williams (Hounslow), Ltd. and Imperial Chemical Industries show attractive ranges of colours for foodstuffs and dyes for other industrial purposes; the South Metropolitan Gas Co. and other gas companies show road tars, naphthalene, smokeless fuels etc., and photographic chemicals are to be seen on Johnson's stand and elsewhere. To do justice to each stand would only make for a lengthy catalogue, and in this note we can only indicate the vast range of products, commenting as we do so on the attractive way they are exhibited. Imperial Chemical Industries, Ltd. has, as usual, aimed at something of a distinctive note in its main stand, and has achieved it with an excellently designed layout. An interesting feature of this stand is the projection of the outlines of crystals, magnified many times, on to glass screens—several crystals providing very beautiful figures.

The main feature of this section of the exhibition is undoubtedly the advance which is indicated in the use of plastics. There are some thirty odd exhibitors of plastic mouldings and materials, and several new names are to be found amongst those which are widely known, such as Bakelite, Ltd., British Xylanite, Ltd., Beetle Products, Ltd. There seems to be no end to the uses to which plastics can now be put, and every kind of moulding from tea cups to wireless cabinets and car fittings to telephones are shown. The Bakelite laminated boards veneered with wood finishes which are exhibited have such a fine appearance that they are bound to attract those interested in building and furnishing. Of the remaining stands connected with the chemical industry that of Johnson, Matthey & Co., with its exhibits of assaying chemicals and precious metals, is one of those deserving a prolonged inspection, and the stand of Solvent Products, Ltd. is of interest, especially to those who have not seen solid carbon dioxide.

Of the rest of the Fair at Olympia it need only be said here that it is amazing in its scope and variety. There is something for everyone to see, whether one is interested in foodstuffs or billiards tables, toys or tobacco, grand pianos or tennis racquets. The Empire Marketing Board has surpassed the excellent standard which it set itself by its display in previous exhibitions; the section which deals with Canadian products is particularly fine and the whole exhibit is an impressive demonstration of the resources in the British Isles and overseas. It includes a cinema which shows films illustrating industries within the Empire. One could spend an hour or more with profit on the stand of the British Optical Instrument Manufacturers' Association alone, and if indeed the visitor needs a word of advice, it is to prepare himself not for a brief hour or two, but a day at the Fair, and if possible longer.

CANADIAN MINING

The output of Canadian nickel for 1932 is estimated at 29,274,871 lb. valued at $6,987,000 as against 65,666,320 lb. worth $15,267,453 in 1931. Miscellaneous metals were valued at $2,894,000 against $3,993,858.

SOCIETY OF CHEMICAL INDUSTR[Y]

OFFICIAL NOTICES

Unpaid Subscriptions. The annual subscriptio[n] of the Society is due on or before January 1 each yea[r] unless a member has notified his intention of resignin[g] in writing before that date. It is customary to continu[e] posting the JOURNAL for a few weeks to all member[s] remaining on the register, after which period it is temporarily withheld while the subscription remain[s] unpaid. It will save unnecessary correspondence if thi[s] practice is made widely known.

Indexes. Members are reminded once again that th[e] two indexes to the JOURNAL and ABSTRACTS respectivel[y] will be distributed together at the end of March or earl[y] in April and that all paid-up subscribers or member[s] of 1932 will receive copies without further application.

British Industries Fair. Members visiting th[e] British Industries Fair at Olympia, which opened o[n] Monday, February 20, are reminded that the Society['s] Stand Number is A.14 in the Chemical Section.

The Stand will make an excellent rendezvous whil[e] visiting the exhibits and it should be noted that th[e] Society's telephone number at the Exhibition is Shepherds Bush 4745. The Society has no admission ticket[s] but cheap railway vouchers may be obtained from th[e] General Secretary.

Binding the Journal. Special arrangements hav[e] been made with Messrs. Gurney & Jackson for th[e] preparation of binding cases, or for the complete work of binding in several styles. The charges are particularly reasonable and the General Secretary, on request, can supply details, but the order must be place[d] direct with the bookbinders.

LIVERPOOL SECTION

A meeting of the Liverpool Section was held in th[e] Chemistry Department, University of Liverpool, on Friday, February 17, with Mr. E. Gabriel Jones in th[e] chair. A lecture entitled "The Production and Use[s] of Solid CO_2" was delivered by Dr. H. G. Littler, who gave an outline of the historical development of the solid CO_2 industry in England and the U.S.A. It was shown that the thermodynamic principles underlying the production of solid CO_2 were now well worked out and that the problems to be solved in the production of dry ice were connected with the purification of the gases and the mechanical production of "dry ice" of good quality. Two applications of solid CO_2 were discussed, namely the use of "dry ice" as a refrigerant and its use as a source of CO_2 gas. It was shown that the successful use of "dry ice" as a refrigerant depended upon the proper methods being employed for controlling the rate of evaporation. The economics of the use of a low-temperature refrigerant were considered, and the methods employed in the use of solid instead of liquid CO_2 as a source of gaseous carbon dioxide were described. A short description was also given of the methods employed in distributing solid CO_2 throughout the U.K. from a single producing centre. Finally, reference was

made to the bactericidal and insulating properties of gaseous carbon dioxide.

A discussion followed in which Mr. E. Gabriel Jones, Mr. E. T. Williams, and Dr. T. Moran, of the Low Temperature Research Station, Cambridge, participated, Dr. Moran referring to the inhibitive action of carbon dioxide on the growth of moulds and bacteria in meat and fish, some account of which work has already appeared in the JOURNAL.

MONTREAL SECTION

The regular monthly meeting of the Montreal Section which was a " French Night " under the auspices of the French members, was held in the Windsor Hotel on the evening of Wednesday, January 11. Fifty-two members attended the dinner and about seventy-five members attended the lecture, which was presided over by Mr. A. Valin, of the Foods and Drugs Department of the Federal Government. In this lecture Dr. George Baril of the University of Montreal delivered an interesting account of the University and its chemistry department. The lecturer first dealt with the history of the University since it was founded in 1878 as a branch of the Laval University of Quebec. In 1917—18 it included the four faculties of Theology, Law, Medicine, and Arts. In 1920 the Laval University of Montreal obtained its complete autonomy under the name of Montreal University and in the same year the faculty of Pure Sciences was founded. There were now more than 8500 pupils attending lectures, the teaching material amounting to more than $250,000 and implements to $135,000.

Dr. Baril then described the planning and construction of the new buildings of the University which were being built on Maplewood Avenue on a site of more than 100 acres. The total length of the facade of the buildings would be 960 ft., with a tower 240 ft. high over the library. It would be a six-storey building of concrete with the exterior walls in vitrified bricks, the terra-cotta bricks of the interior walls being also finished with vitrified face-bricks so that the whole building would be fire-proof. In planning the building close co-operation had been maintained between the architect and the various faculties, and most of the professors who co-operated had the opportunity first of all of visiting about half a dozen Universities in Canada and Europe. The chemistry department was planned on two floors with a total floor area of 39,000 ft., about 12,000 of which was to be devoted to research laboratories. The research wing would be divided into four sections for inorganic chemistry, organic chemistry, biochemistry, and physical chemistry. Easy access to the roof would enable workers to manipulate noxious gases. In the various laboratories and offices the " unit " system was to be adopted, a " unit " being 16 ft. by 20 ft. Finally nothing would be neglected to maintain the teaching on the highest possible level and to make for the utmost co-operation between the French and English speaking communities.

Mr. J. R. Donald and Dr. Milton Hersey took part in the discussion, and the vote of thanks to the speaker was moved by Mr. J. R. Donald and carried amid applause.

BIOCHEMICAL SOCIETY

The 152nd meeting of the Biochemical Society was held at the Lister Institute, Chelsea Bridge Road, London, S.W.1, on Friday, February 17, when the following papers were read :

" Vitamin-*C* : Specificity of Hexuronic Acid and a Method for its Determination in Foodstuffs by Chemical Means," by T. W. Birch, L. J. Harris, and S. N. Ray. (A) Experiments have been carried out with the object of ascertaining whether antiscorbutic activity is an inherent property of hexuronic acid itself or due to some associated impurity. The evidence is consistently in favour of the former view, a very constant correlation having been established between hexuronic acid and antiscorbutic activity as follows : (1) In the first place it was shown that the antiscorbutic activities of several natural sources were approximately proportional to the amounts of hexuronic acid recoverable from them : thus suprarenal cortex (ox), not hitherto recognised as an antiscorbutic, had three times the potency of orange juice. (2) Specimens of hexuronic acid from different sources (suprarenal ; paprika) were assayed biologically and found to have identical antiscorbutic activity. (3) Hexuronic acid after various repurification processes maintained its original activity. (4) The hexuronic acid contents of numerous natural sources were then determined chemically (by the method described below) and were found to account precisely for their known antiscorbutic activities. (5) In the case of several materials it was also possible to estimate the hexuronic acid content by intensity of absorption at 265 mμ (carried out by W. J. Dann), and this result was in further agreement with the biological or chemical tests. (6) The destruction of hexuronic acid by heat and aëration as measured chemically was found to proceed at a similar rate to that of vitamin-*C* activity. (7) In the guinea pig the antiscorbutic activity of the suprarenal (or liver) was lost with the development of scurvy and this coincided with the disappearance of hexuronic acid. (8) With other animals, the rat and dog, which are able to synthesise their own vitamin when none is provided in the diet, the antiscorbutic activity and the hexuronic acid both remain unaffected.

(B) A rapid micro-chemical method has been devised for estimating the hexuronic acid content of foods, involving preliminary extraction with trichloracetic acid and titration against the oxidation-reduction indicator 2,6-dichlorophenolindophenol in acid solution. Certain naturally occurring reducing reagents, which were found to react when the reducing capacity of foodstuffs was determined according to the Tillmans technique in more neutral solution, did not interfere by this method (special precautions however being necessary in the presence of adrenalin). Sensitivity is about 1 part in 30 ; an amount of vitamin-*C* represented by 0·03 c.c. of orange juice suffices for an accurate assay ; and the determination requires only a few minutes to carry out. Results coincide with those obtained biologically. Values below are expressed as the " minimal protective day dose " for

guinea pig (figures in brackets being the determined or reputed values as measured biologically):

Cabbage 0·9 (1); watercress 1·3 (1); lemon juice 1·5, 1·5 (1·5); orange juice, several types, 1·2, 1·5, 1·9 (1·5); grape-fruit juice 1·4, 1·5 (1·5—2); pine-apple juice 3 (2—3); *imported tomato, juice of*, 4·3 (3—5); *grapes* ≈ 30 (> 20, 40); *imported peach, juice of*, > 60 (—). Horse-radish 0·6 (—). Apples: (Cortex) Bramley's Seedling 5·5 (3—5); Newton 17 (10); Blenheim Orange 29; Edward VII 53 (> 20); Cox's Orange 56 (> 20); Apples (Peel)—Bramleys Seedling 1·2 (1); Blenheim Orange 2·7; Newton 3·7 (3); Edward VII 7·5 (2 ?); Cox's Orange 10 (—). Ox suprarenal cortex 0·5 (0·5); ox liver 1·3 (< 2·8). Cow's milk 47 (20—60); "Ostermalt" 3·3 (—).

(C) The exact antiscorbutic activity of hexuronic acid has been determined by several alternative methods (curative, tooth structure, and preventive). 1·0 c.c. orange juice ≡ 0·5 ± 0·15 mg. hexuronic acid (or best values = 0·6 mg.). *We recommend its adoption as international standard.*

Dissociation constants have been determined from the titration curve: $pk_{a1} = 4{\cdot}14$, $pk_{a2} = 11{\cdot}42$ (pk_{a3} *ca.* 14).

"Spectrographic Analysis of the Nessler-Ammonia Reaction," by C. B. Allsopp and C. G. L. Wolf. In view of the increasing use of photometric methods employing a standard visual darkening or making use of a photo-electric cell instead of a comparison of a standard colour with that of the unknown solution, it was thought desirable to study the absorption spectrum of the orange-red colour formed by the action of Nessler's solution on a salt of ammonia. The absorption spectrum of Nessler's solution itself is similar to that of yellow-coloured K_2HgI_4, and consists of a strong band at 2900 Å.U., 1000 times more intense than the absorption in the visible spectrum, with a "step-out" at 3500 Å.U. The addition of ammonia produces no change in the position or intensity of the absorption band, and does not seriously affect the absorption at long wave-lengths, but the absorption in the blue and early ultra-violet spectrum appears to be enhanced. Evidence is adduced to show that the yellow colour produced is probably not a true absorption colour, but that it results from scattering of blue light by colloidal particles of ammonium mercuric iodide. The conclusion is drawn that great caution must be exercised in attempts to estimate ammonia by methods which depend on the use of interpolation curves based on measurements of the light transmitted by coloured Nessler's solutions.

"Action of Nitrous Acid on the Oxytocic Principle of *the Pituitary Gland,*" *by J. M. Gulland.* Nitrous acid at p_H 3 has two actions on purified preparations of the hormone. In one minute a large excess of nitrous acid reduces the oxytocic strength to 36% of the initial value, and after 25 minutes it is still 33%. The concentration of nitrous acid has not fallen to any significant extent during this period. The prolonged action of nitrous acid, of which the concentration is restored at intervals almost to the initial value, slowly reduces the oxytocic strength and this is still 2% after 78 hours. This slow decrease is not due to instability of the first product of the reaction either when preserved in samples at p_H 7·4 or at p_H 3 during the experiment. Some implications of these results are discussed and considered in conjunction with the observations that neither the hormone nor the products of its interaction with nitrous acid are inactivated by semi-carbazide or hydroxylamine at M/50 concentrations. It is possible that nitrous acid does not reduce the oxytocic value to zero. Hydroxylamine at a dilution of 1 in 500,000 in the bath causes a diminution in the response to a dose of pituitary extract or of histamine corresponding approximately to a reduction of the dose by 20%. An improved system for emptying and filling the testing-bath is described, and the effects of preserving uterine horns in ice-cold Ringer solution are discussed.

"*Action of Proteolytic Enzymes on the Oxytocic Principle of the Pituitary Gland,*" by J. M. Gulland and T. F. Macrae. The hormone is destroyed slowly by amino-polypeptidase preparations from English brewers' yeast. It is destroyed very rapidly by preparations of yeast dipeptidase and yeast proteinase. None of these enzymes is responsible for the inactivation which is caused by a fourth enzyme present in these preparations. This enzyme has a p_H optimum of p_H 7·4 and is slightly active at p_H 5 and p_H 9·5. At p_H 10 it is slowly destroyed, but is stable at p_H 5. It is liberated rather rapidly from autolysing yeast and accompanies the proteinase and dipeptidase. Grassmann's aminopolypeptidase and dipeptidase preparations behave similarly to those from English yeast.

Papain preparations destroy the hormone rapidly and the p_H optimum and activity curve are the same as those of the yeast enzyme. It is probable that the destruction by papain preparations is caused by this enzyme rather than by papain itself.

"Preparation of Proteolytic Enzymes from Yeast," by T. F. Macrae. Pure preparations of dipeptidase and amino-polypeptidase have been obtained from English brewers' yeast. Yeast proteinase has been obtained free from dipeptidase, but not free from amino-polypeptidase.

"Glyoxalase Activity of the Red Blood Cell. The Function of Glutathione," by M. Jowett and J. H. Quastel. A study has been made of the glyoxalase activity of human erythrocytes by the manometric methods of Warburg. These cells have a high glyoxalase activity ($Q_M^{N_2} = 60$), which almost vanishes on complete lysis of the cells with distilled water. The diminution in activity of the cells by lysis is apparently due to dilution of the glutathione (GSH) present in the intact cell. Addition of GSH to lysed cells restores the glyoxalase activity, the rate being determined by the GSH concentration.

GSH combines reversibly with methyl glyoxal; this may be indicated (*a*) manometrically, (*b*) iodimetrically, (*c*) by the effect of glutathione on the glyoxalase *activity of intact cells. The evidence suggests the following chain of reactions taking place in presence of the enzyme:*

$$CH_3CO{\cdot}CHO + HS{\cdot}G \rightleftharpoons CH_3CO{\cdot}CHOH{\cdot}SG \xrightarrow{H_2O} CH_3CHOHCOOH + GSH$$

Glyoxalase activity of intact erythrocytes is diminished by the presence of oxygen, the diminution being greater the longer the exposure of the cells to O_2 and the better they have been washed. The diminution in glyoxalase activity is greatly decreased by the presence of glucose. Glucose, however, does not affect the inhibition by O_2 of the glyoxalase activity of lysed cells. In the presence of glucose the inhibitory action of O_2 on glyoxalase activity (17—20%) is reversed by subsequent transference to N_2. The evidence indicates that the glyoxalase activity is determined by the GSH concentration, which, itself, is determined by the relative rates of oxidation and reduction in the cell.

The bearing of these phenomena on the Pasteur reaction is noted.

"Influence of the Duration of Vitamin-*A* Tests on the Degree of Accuracy Obtainable in these Tests," by K. H. Coward. The increased degree of accuracy obtainable in vitamin-*A* tests (growth response after cessation on a vitamin-*A*-free diet) by prolonging the test period beyond 3 weeks is so slight as to make the extra time and labour involved, in general, unjustifiable. This has been determined from (*a*) the standard deviation of the mean increase in weight of about 2500 rats in vitamin-*A* tests after 1, 2, 3, 4, and 5 weeks of the test, (*b*) the curves of response of 5 groups of about 30 rats each to graded doses of one sample of cod-liver oil after 1, 2, 3, 4, and 5 weeks, and (*c*) a calculation of the range of dose corresponding to the probable error (10 rats in a group) of the mean increase each week. Thus the probable error for 10 male rats is + 42, 28, 21, 19, 17 or − 31, 23, 18, 16, 15% for 1, 2, 3, 4, 5 weeks respectively and for 10 female rats + 51, 34, 30, 27, 24 or − 34, 25, 23, 21, 19% for 1, 2, 3, 4, 5 weeks respectively.

CHEMICAL SOCIETY

Seventy-two new Fellows were elected at an ordinary scientific meeting held on February 16, when the President, Prof. G. G. Henderson, F.R.S., occupied the chair.

The meeting was devoted to a discussion on "The Raman effect in relation to some chemical problems," opened by Dr. J. J. Fox, O.B.E. The following is a summary of Dr. Fox's contribution :

When light falls on a substance it is "scattered" by the molecules, the greater portion of the light passing through the substance, if transparent, but more or less being emitted in a direction perpendicular to the direction of the incident light. This perpendicularly scattered light may show itself in several ways: (1) Rayleigh scattering, in which the frequency of the incident light is unaltered and the intensity of the scattered light is inversely proportional to the 4th power of the wave-length, (2) fluorescence, where the scattered light has in general a lower frequency which remains fixed whatever the wave-length of the incident light so long as it is below that of the fluorescence, (3) Raman effect. In this last case the final result is that the incident photon, $h\nu$, gives up part of its energy to the molecule which is thereby excited to one of its characteristic states, the remaining energy appearing as a photon $h\nu'$ where ν' is less than ν. Some molecules being already in an excited condition at ordinary temperatures, there is a chance that of the molecules in this state some may impart their characteristic energy to the photon producing $h\nu''$ where ν'' is greater than ν. This is the "anti-stokes" line and will occur much less frequently than ν'; hence the "anti-stokes" line is of much weaker intensity than the line ν'. An explanation of this kind for the Raman effect is, however, not in accordance with rigid treatment of the subject. Briefly, the view now is that three energy levels are concerned in the process: a molecule may have energy levels such that transitions are possible from say level l to m or from l to n, and in this case a Raman frequency may arise which is the difference of the two levels m and n, one at least of which is a frequency of a band in the infra-red spectrum of the molecule. A comparatively simple mathematical treatment of this subject is given by Howlett (Canad. J. Res., 1931, **4**, 79).

Infra-red spectra of molecules provide precise information about the dynamic relations of groups of atoms in molecules. For example, in HCl gas, a strong band is found at 3·46 μ for the vibration of the nuclei along the line of their union, but the centre of the band is missing, whereas the branches of the band on each side show the characteristically spaced lines of the states of rotation of the HCl molecule, from which the moment of inertia, and hence the distance between the nuclei, may be evaluated. The central missing line may be considered to be that part of the vibration band for which the molecule does not undergo any change in rotation; this would apparently be of such rare occurrence that it does not appear in the combination vibration–rotation band at 3·46 μ. Now Wood found that the Raman line for HCl occurred at 3·465 μ, exactly where the infra-red spectrum showed that no change of rotation occurred in the HCl molecule. It thus appears from the Raman line that the probability is greatest of a transition occurring between two states of the molecule when the electric moment does not become displaced, and the favourable condition for this is when the vibration is along the line joining the nuclei and no change in rotational energy occurs. Similarly a Raman line is found equivalent to 9·1 μ for calcite, where no infra-red band is found; but a fundamental band is necessary at 9·1 μ in calcite in order to obtain the combinations which describe the band system actually found.

Raman scattering is a phenomenon of polyatomic molecules or of groups forming them. Hence Raman lines are observed with liquid H_2, O_2, and so on, but not with liquid He. A few examples will be given of the use of determinations of Raman frequencies in arriving at the energies associated with molecules considered as dynamic systems. Each molecular species has a definite Raman frequency, modified a little by the nature of the other groups associated with it, *e.g.*, C–H, about 2900 cm.$^{-1}$, C = O about 1700 cm.$^{-1}$, C = C about 1600 cm.$^{-1}$ An N–H vibration gives three frequencies of which the central one is about 3300 cm.$^{-1}$. Its position is only very slightly affected in substances such as hydrazine, and it corresponds very closely with the very pronounced *Q* branch of the NH_3 infra-red band observed by us at 2·998 μ;

gaseous NH_3 has a Raman line at 3334 cm.$^{-1}$, or 2·999 μ. Study of the Raman spectrum of benzene and its derivatives has brought out some striking features, of which one, for example, is the persistence of certain vibrations even when marked substitution has taken place. For example, the 1600 cm.$^{-1}$ line persists from benzene through all the chlorine derivatives down to hexachlorobenzene, the only effect being a small diminution in frequency due to weighting of the molecule, as the following results show:

C_6H_6	C_6H_5Cl	$C_6H_4Cl_2$	$C_6H_3Cl_3$	$C_6H_2Cl_4$	C_6HCl_5	CCl_6
1584	1580	1572	1560	1558	1553	1510 cm.$^{-1}$

This frequency according to Andrews (Physical Rev., 1930, **36**, 537) arises from stretching of double bonds of a "Kekulé" model of benzene. Another peculiar feature of halogen substituted benzenes is the occurrence of the strong Raman line at 992 cm.$^{-1}$ only in benzene, chlorobenzene, *m*-dichlorobenzene, and symmetrical trichlorobenzene. A probable explanation is that this frequency is due to a symmetrical vibration of alternate C atoms along the radial lines and that unsymmetrical substitution upsets this pulsation by reducing the frequency considerably, or stopping it.

An example of the individuality of the groups was found by us with citral; here we find the C = O, C–H, CH_2, C = C vibrations and the effect of CH_3 groups, all in one molecule.

Carbon monoxide is of special interest to us because it has a Raman line at 2155 cm.$^{-1}$, which is in the region of frequencies proper to triple bonds, and is altogether different from the 1700 cm.$^{-1}$ C = O vibration in ketones and esters; it agrees in frequency with that found for nitriles and *iso*nitriles, a fact which led Dadieu to the conclusion that these must be formulated as R–N ⇄ C (cf. Hammick, New, Sidgwick and Sutton, J., 1930, 1876).

Nitriles in general have a Raman line about 2250 cm.$^{-1}$, which is characteristic of the –CN group, for it is in the same region, but lower, for cyanides; potassium cyanide has the line 2082 cm.$^{-1}$, and potassium thiocyanate at 2067 cm.$^{-1}$.

Further examples of the effect of groups are readily found; the persistence of the line about 1300—1400 cm.$^{-1}$ for the NO_2 group is noteworthy. Nitric acid (65 to 100%) has the line about 1300 cm.$^{-1}$; nitromethane, nitrobenzene, nitrites, and nitrates give a somewhat higher frequency. One line characteristic of nitrates and nitric acid is 1050 cm.$^{-1}$ (approx.); and this line increases in intensity on dilution, a fact consistent with increasing ionisation, whereas the 1300 cm.$^{-1}$ line due to the –NO_2 group diminishes as the molecule ionises. (Rao, Proc. Roy. Soc., 1930, **127**, 279). It has been stated that determination of the intensity of the Raman line in this case gives a direct measure of the number of ions present in strong solutions of nitric acid.

The sulphate ion in all the compounds so far examined, whether in crystals, or in solutions of the sulphates, has a line about 980 cm.$^{-1}$, independent of the cation with which the –SO_4 group is associated. A line close to this is also found with pyrosulphates, tungstates, molybdates, and perchlorates; but one of lower frequency about 850 cm.$^{-1}$ with chromates, selenates, and periodates. The implication is that all these –MO_4 groups are of like structure.

One important generalisation on the relation between the frequency of the Raman line and the binding force of the bond is the relation worked out by Dadieu and Kohlrausch, namely that $\nu = \frac{1}{2\pi}\sqrt{f/\mu}$, where f is the elastic restoring force and μ is the reduced mass. If the greatest amplitude of vibration is put = a, then $f\,a/2$ gives an approximate measure of the binding force. It is possible to utilise such a simple expression since the vibrating atoms in a molecule to which the Raman frequency is assigned can be regarded as if they were an isolated diatomic pair.

The following took part in the discussion, an account of which will be given in a subsequent issue of CHEMISTRY AND INDUSTRY: Sir Robert Robertson, K.B.E., F.R.S., Prof. W. E. Garner, Prof. T. M. Lowry, C.B.E., F.R.S., Mr. C. R. Bailey, Dr. C. P. Snow, Dr. H. J. Emeléus, and Mr. W. F. K. Wynne-Jones.

INSTITUTION OF CHEMICAL ENGINEERS

Annual Corporate Meeting

The eleventh annual corporate meeting of the Institution of Chemical Engineers was held at the Hotel Victoria, London, on Friday, February 17, and was followed by the annual dinner in the evening. Lord Leverhulme, the President, was in the chair.

In presenting the annual report of the Council and the accounts at the morning session the President spoke of the satisfactory manner in which the membership had been maintained and indeed slightly increased during the past year, and in a personal capacity mentioned the great loss which had been sustained in the death of Sir Arthur Duckham. Looking at the position generally he said we need have no fear as to the future of chemical engineering nor as to the quality of those who were coming along to continue the work, for he had been much impressed with the students and graduates of the Institution.

Annual Report of the Council

Mr. H. W. Cremer (Hon. Secretary) in a general review of the work of the Institution during the past year said that from the membership point of view it was very pleasing to notice the number of requests for information concerning the Institution and the necessary qualifications for membership. From this it was evident that those engaged in the chemical and allied industries were becoming increasingly alive to the advantages attaching to membership of the one professional organization dealing with chemical engineering. There was ample evidence that the Institution now represented a very living force in the indnstrial, edncational and, he might say, the social life of the country, quite apart from the ties which it had formed with the Dominions through its members resident overseas and with the corresponding body in the United States. The total membership for the year ended December 31, 1932, was 726, compared with 700 at the end of December, 1931. The Education Committee was now engaged in the modification of the Memorandum issued eight

years ago on "The Training of a Chemical Engineer," it being felt that some revision was necessary in the light of developments since the original issue. The question of possible future developments in the present methods of training chemical engineers was also receiving very full consideration. The provision of the new chemical engineering laboratory at King's College, London, was a very pleasing sign following so closely after the opening of the new Ramsay Memorial Laboratory at University College. In conclusion Mr. Cremer paid a warm tribute to the work of Mr. Mackie (the assistant secretary) and his staff, whose willingness and cheerfulness under the most trying conditions never flagged.

Mr. F. A. Greene (Hon. Treasurer) presented the accounts, and referring to the small deficit of £8 said that although it might be argued that there should not be any loss, it must be remembered that the Institution could only do its work efficiently by wisely spending the money it received. It was not a savings bank and the policy was to try and arrange things so that the expenditure and income more or less balanced.

The report and accounts were then adopted.

It was announced that the following had been elected to the Council for the coming year:

President: The Rt. Hon. the Viscount Leverhulme; *Vice-Presidents:* Dr. H. Levinstein, Mr. H. Talbot; *Hon. Secretary:* Mr. H. W. Cremer; *Hon. Treasurer:* Mr. F. A. Greene; *Members of Council:* Mr. E. Briggs, Mr. H. J. Pooley, Dr. F. S. Sinnatt; *Associate Members of Council:* Mr. C. C. H. Brazier, Mr. H. A. S. Gothard.

The medals were then presented as follows: The Osborne Reynolds Medal to Mr. S. G. M. Ure, Hon. Editor of the Transactions for seven years; the Moulton Medal to Dr. C. M. White for his paper on "Fluid Friction and its Relation to Heat Transfer"; the Junior Moulton Medal to Dr. W. B. Hawes (Graduate) for his paper on "Some Sidelights on the Heat Transfer Problem."

Cordial votes of thanks were passed to the President for his services during the past year, to the assessors in connexion with the award of medals, and to the honorary officers and council.

Presidential Address

Lord Leverhulme then delivered his Presidential Address. In this he briefly traced the history and development of the soap industry illustrating his remarks with lantern slides showing ancient and modern methods of soap making including some illustrations of the latest soap factory to be built, viz., that for the American firm of Lever Bros.

At the afternoon session a paper entitled "Metallurgy from the Standpoint of the Chemical Engineer" was read by Mr. L. Singlehurst-Ward.

Annual Dinner

The annual dinner was held at the Hotel Victoria on Friday, February 17, the Rt. Hon. Viscount Leverhulme presiding over a company of more than 200 members and guests. Among those present were Sir Frederick Gowland Hopkins, P.R.S., Dr. Herbert Levinstein, Dr. A. C. Seward, F.R.S. (Master of Downing College, Cambridge), Prof. H. E. Armstrong, F.R.S., Dr. R. H. Pickard, F.R.S. (President, Society of Chemical Industry); Mr. W. A. S. Calder (Past-President of the Institution), Mr. J. Arthur Reavell, Dr. E. F. Armstrong, F.R.S., Prof. F. G. Donnan, F.R.S., Mr. C. S. Garland, Mr. H. Talbot, Mr. F. A. Greene, Mr. J. F. Ronca, Dr. R. Lessing, Mr. R. E. Gibson, Dr. W. R. Ormandy, Mr. H. J. Pooley, Dr. Stephen Miall, Sir Robert Robertson, Mr. F. H. Rogers, Dr. R. Seligman, Mr. L. H. Sensicle, Mr. S. G. M. Ure, and Dr. W. Cullen.

Proposing "The Institution of Chemical Engineers," Sir Frederick Gowland Hopkins said that it needed the repercussions of the Great War to bring chemical engineering and its great activities into being. When the late Lord Moulton was Chairman of the Medical Council in the early days he had said, only a short time before the war and little knowing what was before us, that there were two people who needed encouragement in this country, namely, the biochemist and the chemical engineer. That was typical of the late Lord Moulton's great wisdom and the Institution of Chemical Engineers, once formed, had been very faithful to the ideals of its founders, more especially with regard to its policy of technical education and also in regard to research. From the point of view of the technical education of the younger members of the profession, the Institution was in the forefront of professional associations whilst it was to be congratulated on the wonderful researches it had encouraged. It was often said that this country did not carry out the same amount of industrial research that other countries did, and he did not know whether that was right or not, but certainly the amount of valuable research that had been done in industry here under the most depressing and difficult circumstances, was a thing upon which this country could congratulate herself. He represented an ancient Society which however was still progressive, and speaking to an energetic Institution concerned with applied science he urged the necessity for those concerned with applied science to work in full sympathy, understanding, and respect with those engaged in scientific research, because both were necessary to industrial progress. Both called for the same intellectual equipment if they were to be successful, and judging by the letter which had appeared in *The Times* under the signatures of two members of the Institution—Prof. Gibbs and Dr. Underwood—he gathered that the Institution as a body sympathized with the need for assisting fundamental research in every possible way. Whether it was the wish of the Institution to promote technocracy—whatever that might be—he did not know, but it could be said that if the engineer were to rule and control the State he would have to call in the biologist at least as his lieutenant. The President of the Institution was a great industrialist but he was in sympathy with the desire that pure science and industrial research should work together.

The President, responding to the toast, said the toast of the Institution on the present occasion was of special significance because the proposer of it was not only President of the Royal Society, but also President of the British Association for the Advancement of Science and for that reason the link between pure and applied science was not a missing one. The Royal Society

was founded in the reign of Charles the Second but whilst that period might have been a good one for pure science it was rather a difficult one for applied science. There was an Excise Duty of 3d. per lb. on soap and that continued until it was abolished by Mr. Gladstone in 1856 with a loss to the revenue of over £1,000,000. The consumption of soap in this country in 1801 was 24,000 tons and when the tax was abolished in 1853 it had only risen to 40,000 tons. In 1930 however, the consumption of soap amounted to 400,000 tons and perhaps it was well that the Chancellor of the Exchequer was not present or he might be tempted to put back the tax on soap, because it did not need a chemical engineer to calculate that if 40,000 tons of soap yielded £1,000,000 in taxes, 400,000 tons would produce £10,000,000. Nevertheless, there was surely a moral to be drawn from this, namely that if industry were to be stimulated taxes should be taken off and not put on. Speaking generally, Lord Leverhulme said that, to use an American expression, we were out for better and bigger business, bigger sales, and better products and to accomplish that there must be a partnership between the business man and the technologist. In this connexion he recounted that one of the sales directors of one of our largest industrial concerns in a recent speech had given an admirable definition of the difference between a salesman and a technician. A salesman was defined as a man who knows a very little about a great deal and keeps knowing less and less about more and more, until he finally knows nothing about everything. A technician, on the other hand, was defined as a man who knows a great deal about very little, and he goes on knowing more and more about less and less until he finally knows practically everything about nothing! Could there, he added, be two components more capable than the salesman and the technician to enter into complete combination in the presence of that very necessary catalyst, the confiding shareholder! Undoubtedly, he concluded, the secret of the perennial youth of the Royal Society was its perpetual quest after the truth.

Dr. Herbert Levinstein, who proposed "Our Guests," referred to the educational work of the Institution and said that specialized education such as the training of the chemical engineer required a perfectly solid secondary education system and a very long preparation for the specialized work to be done later. Chemical engineers have a very important part to play in the world, and that part was the more difficult because of the extraordinarily rapid changes that were taking place. The world would have to take more notice of the chemical engineer than it had done during the past 15 futile and ridiculous years, during which time it had been misled by timid people frightened of their own shadows listening to the popular voice, whilst all the time the people were really saying one thing only, viz., "Tell us what to do." All the time, however, the people who had been governing the world had been listening to something else. None of them had the elementary outlook which, perforce, those who had been brought up in factories had. There was, for instance, the ridiculous arrangement we made to pay America 200 tons of gold a year—it was easier to call the payment 200 tons than £30,000,000—because there were unmined gold resources available and none of the politicians apparently had thought of mining sufficient gold to pay America, leaving our own gold resources untouched and at the same time preventing all the interference there had been with our own currency and every other currency in the world. It would have paid us to do this, as America stupidly insisted upon gold, and it was an instance of the lack of the elementary outlook which everybody in charge of a large factory necessarily acquired; it was merely a question of the quantity to be produced, what it would cost, and when could it be delivered. If the American debt question had been put in that way and answered successfully, we should have escaped a great portion of the miseries which had fallen on the world. It was only when we applied our minds to our own profession that there was that clearer outlook. In the same way, a great deal was heard about the mechanization of agriculture and making big business of agriculture, but was it realized that by proceeding on these lines something like 70% of the population of the world would be put out of employment straight away? The world was divided into two classes, the people who grew things and the people who made things, and all trade and industry was interchange of something that was grown for something that was made. If therefore, large numbers of agricultural labourers were thrown out of work owing to mechanized methods and the desire to make big business of agriculture, an enormous number of mills and factories would have to close down. Therefore, with the world in its present unsettled state there was a great responsibility resting upon the work of the chemical engineer. Dr. Levinstein apologized for introducing these topics at such a cheerful gathering and said he had felt tempted to put forward an argument that was never heard in Parliament and which cut no ice at Geneva and probably would not be discussed at the forthcoming conference, which, he understood, was to be a conference to end conferences and to settle the financial affairs of the world and put every man into employment whatever he was worth at a salary twice what he was worth. That seemed to be the doctrine of all democratic politicians.

Dr. A. C. Seward, F.R.S. (Master of Downing College, Cambridge), made the first reply to the toast, and was followed by Prof. H. E. Armstrong, F.R.S., who said he claimed Sir Edward Frankland as the greatest chemist this country had ever known on account of the immortal service he rendered to the country and the world by giving us pure water; the kind of knowledge that Frankland applied to water now required to be applied to the provision of pure milk. It was only since 1912 that we had learned from Sir Frederick Gowland Hopkins of the need for pure milk and the lesson had to be taught to the country generally. That was where chemical engineering could do a vast amount of work. The purity of milk depended on the proper feeding of cows; that depended on the production of winter food of equal value to that obtained in the summer when the animals were in the field. This, in turn, depended upon proper drying of summer grasses, and we were incompetent to do that at the present

moment. The drying of natural products was one of the greatest problems before the world to-day.

Dr. R. H. Pickard, F.R.S. (President, Society of Chemical Industry), replied on behalf of the kindred societies whose representatives had been so hospitably entertained. Referring to industrial research, he said he was pleased to see the broad outlook adopted by the Institution in seeing that co-operative research did not include only one industry. So many industries were inter-related that a broader outlook must be adopted. There had been the danger of industrial research getting into water-tight compartments, and that must be avoided. At the present time there was a very close relationship between the Society of Chemical Industry and the Institution of Chemical Engineers, and he expressed the hope that this would become even closer in the future.

The final toast of "The President" was proposed by Mr. W. A. S. Calder and was briefly responded to by Lord Leverhulme, who again acknowledged the great assistance he had had from the members of the Council, the Hon. Secretary, and the Assistant Secretary and staff.

CORRESPONDENCE

MICROBES AND DISEASE

SIR,—Your interesting editorial note in CHEMISTRY AND INDUSTRY of the 10th inst. on cold induces reflections about the specificity of bacteria and other forms of microbic life in connexion with disease. You point out that certain bacteria in the absence of sugar can make use of any available nitrogenous constituent of nutrient material and produce toxic products: the diphtheria bacillus for example which is harmless in presence of glucose producing a toxin when incubated in a sugar-free nutrient broth.

It will thus be seen that the behaviour of bacteria etc. in relation to disease is largely a matter of environment, and here I may be allowed to quote from an article which I contributed to the *British Medical Journal* of May 16, 1885, as follows:

"If there be no sugar present in its soil the yeast-plant cannot produce alcohol; but it is not to be assumed (at least, in the absence of sufficient evidence) that this micro-organism can live only upon sugar. It is highly probable, indeed, that any one micro-organism can live and thrive under a variety of conditions and upon a great variety of soils; and so the products of fermentative change must necessarily vary accordingly. Many of them may be poisonous in character while many others may be innocuous. So also it must be with the micro-organisms which are associated with disease, in consequence of which it follows that so-called zymogenic organisms may become pathogenic in character simultaneously with a change of soil or other conditions and *vice versa*."

There is the further point which I have urged again and again, viz., that a certain toxin characteristic of—or at least known to be particularly associated with—any one disease may be producible not exclusively by any one bacterium but by others generally regarded as harmless should they find a suitable environment, that is to say nutrient material in which by their agency the same or intimately related toxic product may result.

It will thus be seen that this branch of biochemistry calls for exact determinations concerning the nature and quantities of materials employed in cultivations as also those of the resulting products.

Such balanced reactions must be determined before the various infective and contagious diseases with all their modifications resulting in part from the action of *mixed* forms of microbic life can be better understood and dealt with.

I am Sir etc.,

Weybridge C. T. KINGZETT

Feb. 16, 1933

PERSONAL AND OTHER ITEMS

The Council of the Iron and Steel Institute has announced the appointment of Mr. Kenneth Headlam-Morley to succeed Mr. G. Lloyd on his retirement shortly from the position of Secretary of the Institute. Mr. Lloyd has been associated with the Institute for thirty years. Mr. Headlam-Morley, who will take up his duties toward the end of June this year, is the son of Sir J. W. Headlam-Morley, a former Foreign Office advisor.

Mr. A. E. Young, M.Sc., has been appointed chemist to the Royal Naval Cordite Factory at Holton Heath, Dorset.

The death has occurred in Sheffield of Mr. G. H. T. Raynor, managing director of Hardypick, Ltd., and a leading Sheffield industrialist. Mr. Raynor was the inventor of compressed air hammer drills, and was credited with nearly 150 British and foreign patents relating to these as well as air compressors, and compressed air coal-cutting machines.

We regret to record the death recently of Mr. Robert Trevithick, the distinguished railway engineer, at the age of 84. Mr. Trevithick held important appointments in India for many years.

Messrs. G. R. Barclay, J. P. D. Coleman, and J. E. Oram, who have held responsible positions for a number of years with Wild-Barfield Electric Furnaces, Ltd., have been elected to the Board of the company.

Mr. Henry Worrall has resigned the chairmanship of the directors of the English Velvet & Cord Dyers' Association, Ltd., a position which he has held since the inception of the Association 33 years ago. He is succeeded by Mr. B. H. Crabtree.

The Gordan Wigan Prize for chemistry has been awarded to Mr. T. P. Hoar, of Sidney Sussex College, Oxford, for his paper on "The Mechanism of the Corrosion of Iron and Steel."

We regret to learn of the death of Prof. Alfred Schaarschmidt, president of the Institute of Chemical Technology at the Charlottenburg Technische Hochschule.

Mr. Kenneth Mackenzie Clark, chairman of the Aluminium Corporation and the International Aluminium Co., left property in England of £100,780.

Exhibition of Plastics at the Science Museum, South Kensington

The Plastics Group of the Society is taking a prominent part in organizing a comprehensive exhibition of plastics material and products. This exhibit, which is the first of its kind in this country, is designed to be instructive principally to industry. It is the first of a

series the Museum authorities hope to arrange to encourage one industry to interest the members of other industries in the application of its products to those industries. It is believed that the examples of the uses of a material for a particular purpose may encourage the conception and development of similar uses in other products or manufactures.

The Exhibition will be opened on April 5 by Lord Irwin (President of the Board of Trade) and will remain open for a period of not less than three months. It will be housed on the second floor of the Museum with an introductory display near the ground floor entrance.

The Plastics Group is working in conjunction with the Department of Scientific and Industrial Research and with the British Plastic Moulding Trade Association. Prof. G. T. Morgan, F.R.S., is chairman of this organizing committee. The Group is arranging exhibits illustrating the development from the earliest raw materials of the finished plastic material or moulding powder which forms the raw material of the moulder. Works of art or utility made from this material are being staged by the Association.

The Plastics Group is also arranging a series of thirteen weekly lectures each covering a separate branch of the main subject. This young industry is developing very rapidly and it is believed the Exhibition will not only demonstrate clearly the extent of progress already made but will point the way to further development.

A certain amount of publicity will be given to the arrangements, but interested members are recommended to make a note of the opening date now.

Chemical Society: Announcements

It was announced on February 16 that at the ordinary scientific meeting on March 16 a discussion on "The chemical constitution of œstrin" will be opened by Dr. G. F. Marrian.

The fifteenth Faraday Lecture, entitled "The relations between stereochemistry and physics," will be delivered by Prof. Dr. Peter Debye in the Lecture Theatre of the Royal Institution, Albemarle Street, London, W.1, on Wednesday, March 29, at 5.30 p.m.

The annual general meeting of the Chemical Society will be held in the Society's meeting room on Thursday, *March 30, at 4 p.m., when the President will deliver* his address entitled "The present position and the future of the Chemical Society." The anniversary dinner will take place on the same evening at Grosvenor House, Park Lane, London, W.1, at 7 for 7.30 p.m.

Chemical Society: New Local Station

At a meeting of Fellows of the Chemical Society resident in the Sheffield district, held on Thursday, February 16, it was decided to form a local section of the Society. The following officers were elected for the ensuing session:—*President:* Prof. G. M. Bennett; *Secretary:* Dr. S. Glasstone; *Committee:* Profs. J. H. Andrew, W. E. S. Turner, and V. Wheeler, Dr. F. Coward, and Messrs. J. Evans, J. Haworth, and W. Ritchings. Preliminary arrangements for a number of scientific meetings to be held in 1933—4 were discussed.

Trade Marks Committee, 1933

The Trade Marks Committee under the chairmanship of the Rt. Hon. Viscount Goschen has begun its investigations, and persons and associations who wish to submit suggestions or to give evidence before the Committee are invited to communicate with the secretary, Mr. R. W. Luce, Industrial Property Department, Board of Trade, 25, Southampton Buildings, London, W.C.2. The Committee was appointed by the Board *of Trade to report whether any, and if so what, changes in the existing law and practice relating to trade marks* are desirable.

The Fourth Census of Production, 1930

The Board of Trade Journal of February 16 publishes a summary of the results of the 1930 Census of Production, in which it is shown that, whilst the gross output of the factory trades had fallen to £2,488,000,000, compared with £2,872,400,000 at the 1924 Census, the mechanical power available had risen from 9,928,500 h.p. to 11,636,700 h.p. The aggregate net output of industry, being the figure resulting from the deduction from the gross value of products of the cost of materials *used and amount paid for work given out,* was £1,431,800,000 as compared with £1,526,200,000 in 1924. The net output in the chemical industry was 7% higher in 1930 than in 1924, and engineering and shipbuilding was 10% higher, but there were substantial decreases in the non-ferrous metals, textiles, leather, and iron and steel industries. The survey includes a consideration of the leading industries in 1924 and 1930, based on numbers of persons employed, gross output, and net output. Mechanical engineering heads the list of industries on all three counts. The leading industries of 1930 are the same as those of 1924, but the lists as a whole show the advance of the engineering trades and the decline of cotton, wool, iron, and steel.

Carcinogenic Hydrocarbons

Following the formulation of the sterols and bile acids as hydrogenated phenanthrene derivatives by O. Rosenheim and H. King (Chem. & Ind. May 27, 1932) the suggestion was put forward by E. L. Kennaway and J. W. Cook (Chem. & Ind., June 10, 1932) that carcinogenic derivatives of 1 : 2-benzanthracene might arise by abnormal sterol metabolism. Further work on the subject by Prof. E. C. Dodds and Dr. J. W. Cook is described in a letter to *Nature* (February 11). Based on the observations that such sterol dehydrogenations do occur in the body, that œstrin is a tetracyclic compound containing an aromatic ring, and that the cell proliferation which characterizes the œstrous stage is in some respects reminiscent of the early stages of malignant growth, Dodds and Cook have sought a correlation between substances having œstrogenic action and those with carcinogenic properties. As a result of this work it is stated that, whilst there is no evidence that carcinogenic compounds arise from œstrin in the body, it has been observed that pure synthetic compounds of known molecular structure can possess both carcinogenic and œstrogenic activity.

Oil and Colour Chemists' Association

The annual dinner of the Association is to be held on March 24 at the Trocadero Restaurant, London, and the annual meeting on April 7.

The Institution of Mechanical Engineers

The annual report of the Institution states that the welding research committee, under the chairmanship of

Prof. F. C. Lea, O.B.E., D.Sc., has prepared a programme of research which includes experimental work to ascertain the mechanical properties of weld metal at various temperatures by short-time tensile tests, impact, bend, embrittlement, creep, and repetition tests. Corrosion tests will be made on weld metal from thirteen electrodes and, for comparison, on one from a weld made by the oxy-acetylene process. Three kinds of test will be made under this heading, namely, the effects of weathering, of a typical boiler water, and of salt water. An important investigation will be that of the effect of heat-treatment on the mechanical properties and the crystal structure of weld metal, and the desirability of such treatment for the removal of stress. A questionnaire has been issued to firms interested in welding and its technique, and the replies received are now being collated.

British Coal Mining in 1932

In surveying the coal industry in Great Britain during 1932, *The Board of Trade Journal* estimates that the total output of saleable coal was 209,250,000 tons, or 10,250,000 t. less than in 1931. The total was the lowest on record since 1898, with the exception of 1921 and 1926, in which years the output was affected by industrial disputes. Shipments abroad amounted to 57,100,000 t., or 4,500,000 t. less than in 1931. Whilst exports to Scandinavian markets showed a substantial recovery and there were increased exports to Canada and America, those to European and Mediterranean markets fell off by 4,500,000 t. The consumption at home was 150,000,000 t., which was 5,600,000 t. less than in the previous year, and represented consumption *per capita* of 67 cwt., which is about 1 ton less than in 1913. The survey points out that however poor conditions in the industry may have been, they were less severe than those of the chief competitors abroad.

Industrial Designs Competition

Particulars of the Tenth Annual Open Competition in Industrial Designs, to be held at the Imperial College of Science and Technology, Imperial Institute Road, South Kensington, London, S.W.7, in June, 1933, have now been issued, and can be obtained from the Secretary of the Royal Society of Arts, John Street, Adelphi, London, W.C.2. Entries for the competition must be sent in by May 20, and the accepted designs are to be exhibited at the Imperial Institute, South Kensington, from August 5 to 31. Scholarships and prizes amounting to about £1500 are offered in connexion with the 1933 competition, including prizes for textile designs, structural designs in concrete and stone, and decorative work in metal and glass.

A Warning to Chemists

We are informed that two men are calling on chemical laboratories in London and the provinces to sell Persian rugs and that they are making unauthorized use of the names of various chemists as an introduction.

Errata

In last week's issue, p. 143, col. 2, line 43, for the word "not" read "now."

In the note on Vitamin-*A* Concentration on p. 146 of the same issue, the name of Dr. Carr's collaborator should be William Jewell, not Newell.

REVIEWS

TINPLATE DECORATION AND THE LACQUERING OF FOOD CONTAINERS. By A. Ll. Matthison. Pp. 156. Birmingham: A. Ll. Matthison. 12s. 6d.

This book is welcome in dealing with a subject about which very little has previously been written, providing a more detailed exposition of the same author's "Stoving Finishes for Tinplate Decorators and Tin Box Manufacturers," published in 1928. The material is divided into two parts, the first being a practical treatise on tinplate decoration, an art in which the worker has two raw materials to deal with, namely the tinplate and the varnish or lacquer. When faults occur, as they do occasionally, the lacquer may be condemned when the trouble is due to dirty or otherwise faulty plate. It is not surprising therefore that the author in describing the manufacture of tinplate, should stress the defects in the finished sheets which influence the subsequent application of the lacquer. This leads on to stoving ovens and lacquering machines, and the observations and graphs in the chapter on "Temperatures in Rapid Ovens" are particularly valuable. The articles which follow contain some useful hints and suggestions for the practical man, and they deal with amongst other subjects—Printing Ink and Drying of Varnish; Covering or Spreading of Varnish and Lacquer; The Care and Storage of Varnish: Wrapping and Packing for Transit; and Tooling and Draw Oils. In the last article Faults and their Causes are summarized.

The second part—"Lacquers for Food Containers and Closures"—contains much of interest and instruction to those engaged in the canning industry, an industry which has developed very rapidly in this country during the past five years. The author reviews the findings of a Committee appointed in America in 1923 to enquire into the standardization of tinplate, and follows with a brief account of research work on the same subject in England. It is encouraging to note that the tin producers and the tinplate manufacturers are alive to the importance of the subject. After briefly discussing lacquers for the inside and outside of cans, comparison is made between American and British methods of retorting meat and fish products packed in glass with lacquered metal caps.

Some ten pages are finally devoted to "American Practice," in which the author gives the results of his observations during a recent visit to America, where he was shown over many of the largest can making and canning factories. The sixty-six illustrations, of which the majority are microphotographs of a very high order, should of themselves be of great assistance to the technologist engaged in the tinplate or canned food industries.

HANDBUCH DER CHEMOTHERAPIE. By Dr. V. Fischl and Prof. Dr. H. Schlossberger. Metallfreie Organische Verbindungen. Pp. viii + 357. Leipzig: Fischer's Medizinische Buchhandlung, 1932. 34 m.; subscription 29 m.

This book is an interesting experiment in chemotherapeutical literature, being written by a chemist and a medical man, each of whom, in his own sphere, has had experience of research work in chemotherapy. As

a result neither the chemical nor the biological side of the subject is unduly stressed, and, perhaps for the first time, a well-balanced account of chemotherapy as a whole is presented. The arrangement of the matter is primarily chemical, which has the disadvantage that references to particular groups of therapeutical agents are distributed throughout the work. Anthelmintics for example are mentioned under acyclic chloro-compounds, also under hydroxy- and oxo-compounds and again under alkaloids. This is inevitable and an arrangement of the material under particular infections, would merely have spread the chemical instead of the biological data. In spite of this inherent difficulty, the authors have produced a remarkably orderly treatment of the subject and if this first volume is a fair sample of the complete work, there is every reason to expect at last the comprehensive and critical survey of chemotherapy which has so long been needed. Chemotherapy is still so new a branch of scientific effort that even in sections where research has been intensive there are many gaps to be filled. For that reason some of the sections of this work appear sketchy, but that is no fault of the authors. When they come to deal with such subjects as the cinchona or ipecacuanha alkaloids or the Flacourtiaceous oils, where botanical, chemical, and clinical information is abundant they provide monographs which are clear, critical, and complete. An unusual feature of such a work is the space (18 pages) devoted to what may be called native drugs and domestic remedies, and the authors appear to be firmly convinced that the vegetable kingdom, particularly in the Tropics, may still yield new remedies for parasitic diseases, an optimistic view since no new vegetable drug of first-class importance has been discovered for at least half a century. But their optimism has at least led to the inclusion of a good deal of interesting and useful information. It must not be assumed from the foregoing that the more familiar branches of chemotherapy are neglected. The reader will find excellent accounts of the genesis of the modern anti-malarial, trypanocidal and other parasiticidal drugs, but most of these have already received so much publicity that readers may be glad to hear of a work in which the all-round progress of chemotherapy is critically surveyed. T. A. H.

EISEN- UND STAHLLEGIERUNGEN: PATENTSAMMLUNG. By A. Grützner. 8th revised edition. Edited by the German Chemical Society. Pp. 308. Berlin: Verlag Chemie G.m.b.H., 1932. 32 rn.

This reference book consists of a very valuable collection of details arranged in tabular form to serve as a ready guide to all the existing information on the uses, and patents covering the uses, of irons and steels of various composition. The elements entering into the compositions are first given, then analytical information on the extent to which each is present, and finally a guide to the literature and patents covering each specific composition. The information is culled from the literature of many countries, and to those metallurgists who do not know the earlier editions the book can be recommended for its compactness and comprehensiveness and its easy mode of reference, by which they will probably be saved many hours of searching after information.

ENZYKLOPÄDIE DER TECHNISCHEN CHEMIE. Edited by Prof. Dr. F. Ullmann. 2nd revised edition. Vol. 8: Natriumverbindungen-Salophen. Pp. iv + 860. Berlin: Urban & Schwarzenberg, 1931. Paper, 42·50 rm.; bound, 50 rm.

The latest volume of "Ullmann" covers "Natriumverbindungen" to "Salophen," and thus includes valuable sections on paper (34 pp.), ozone (13 pp.), mercury and its derivatives (40 pp.), and photography and photographic papers (72 pp.). Evidence that the volume has been brought well up to date is provided by the many references to recently developed so-called vitamin food preparations, and by articles such as that describing work on rhenium up to the end of 1930. The standard set by the earlier volumes, both as regards treatment of the subjects dealt with and the excellence of the illustrations and printing, is well maintained by the present volume. H. F. GILLBE

PARLIAMENTARY NEWS

Sugar Beet Industry

In reply to Mr. Campbell, Major Elliot said the approximate amount of the difference between the amount of duty actually charged on sugar delivered for refining in refineries from April 25, 1928 to December 31, 1932, and the amount which would have been paid on the same quantities had duty been charged at the basic rate appropriate to imported sugar exceeding 98° polarization was £18,835,000. The amount of assistance given to the beet-sugar industry during the period April 1, 1928, to December 31, 1932, was approximately £22,379,000, comprising £17,061,000 direct subsidy paid under the British Sugar (Subsidy) Act, 1925—including the sum of £183,300 advanced under the British Sugar (Assistance) Act, 1931—and £5,318,000 representing the difference between the amount of duty collected on home-grown sugar calculated at the appropriate Excise rate and the amount which would have been paid had duty been charged at the basic rate for imported unrefined sugar.—Feb. 14.

Fuel Research Board

Answering Mr. T. Williams, Mr. Baldwin said that no change had been made in the general policy governing the work of the Fuel Research Board since the general election of 1931. The schemes described by the then Secretary for Mines on May 5, 1931, had proceeded, with slight modification. The actual expenditure on fuel research is shown in the following table:

	Net expenditure from scientific and industrial research vote £	Allied Services (H.M. Office of Works, Rates, Postage) £	Total £
1928—29	77,877	10,363	88,240
1929—30	84,706	7780	92,486
1930—31	87,412	5404	92,816
1931—32	82,706	9752	92,458
1932—33 (estimated)	88,886	7712	96,598

—Feb. 14.

Anglo-Persian Oil Company

In reply to Mr. Thorne, Sir John Simon said the only special expenditure incurred by His Majesty's Government in connexion with the dispute with the Persian Government regarding the Anglo-Persian Oil Company's

concession amounted to approximately £200, being the expenses of sending officials to Geneva in connexion with His Majesty's Government to the Council of the League of Nations.—*Feb. 14.*

COMPANY NEWS

ENGLISH VELVET & CORD DYERS' ASSOCIATION, LTD.

The Association records a loss during 1932 of £13,948, which is attributed to the prevailing unsatisfactory trading conditions. At the 34th annual meeting in Manchester recently it was stated that, since the dispute between China and Japan, trade with these countries had been insignificant. A dividend of 5% on the preference shares for the last half-year has been declared.

UNITED STATES STEEL CORPORATION

The quarterly dividend on the 7% cumulative preference stock of the corporation has been declared at 50 cents per share as compared with $1·75 in the previous quarter. This represents a reduction of the annual rate of dividend from 7% to 2%, and this is the first occasion that a reduction has been made since the formation of the corporation in 1901. The net loss for the fourth quarter of the year 1932 was $20,871,000, compared with $4,376,000 in the same quarter in 1931, and the total reduction in surplus for the year was brought to $90,186,000. Operations of the corporation in 1932 were on an average only 18·3% of normal capacity, the low record of 13·6% of capacity being recorded in August last.

BORAX CONSOLIDATED

The divisible profit of the company for the year ended September 30, 1932, was £200,787, after providing for all management expenses. This total compares well with the profit of £188,250 in the previous year. Debenture interest and preference dividend absorb £129,193 and after provision for depreciation etc. £202,192 remains which the directors propose to carry forward.

BRADFORD DYERS' ASSOCIATION

The accounts of the Association to December 31, 1932, show a loss for the year of £54,030, after providing £177,198 for depreciation and crediting surplus provision for income tax. Last year the Association recorded a loss of £12,215 after provision of £190,379 for depreciation. In addition to £24,187 brought forward, and profit on investment £1024, £250,000 has been transferred from reserve to profit and loss. After provision for interest on debenture stock and preference dividend, a credit balance of £34,545 remains to go forward.

COURTAULDS, LTD.

The company's preliminary statement shows a net profit for the year of £1,452,043 after writing off or reserving £207,007 for Continental investments and advances, as against £1,101,587 in 1931, when no reservation for Continental investments was made, £1,000,000 having been taken from reserves for the purpose. A final dividend of 2¾% is now recommended on the ordinary shares (£24,000,000) as compared with 3% last year. A balance of £239,387 is to be carried forward, which is an increase over the previous year of £92,043.

MARKET REPORT

This Market Report is compiled from special information received from the manufacturers concerned.

Unless otherwise stated, the prices quoted below cover fair quantities net and naked at sellers' works.

The following alterations in prices are reported since the publication of the last Market Report (cf. **Chem. & Ind.**, Feb. 3, 1933, p. 109).

TAR PRODUCTS

Acid Carbolic.—Crystals—9d.–11d. per lb. Crude 60's, 1s. 11d.—2s. per gal.

Xylol.—2s. per gal. Pure, 2s. 2d.

Naphtha.—Solvent 90/160, 1s. 5d.—1s. 6d. per gal. Solvent 95/160, 1s. 7d.—1s. 8d. per gal. Solvent 90/190, 1s.—1s. 2d. per gal.

Toluole.—90%, 2s.—2s. 1d. per gal. Pure, 2s. 4d.—2s. 5d. per gal.

PHARMACEUTICAL AND PHOTOGRAPHIC MATERIALS

Acid, Citric.—9½d. per lb. Less 5%.

Iodine Resub., B.P.—14s. 8d.–18s. 9d. per lb.

Iodoform, B.P., Cryst., Precip. or Powder.—17s. 7d.—21s. 7d. per lb.

Iron Ammon. Citrate.—B.P.—1s. 10d. per lb. for 28-lb. lots. Green, 2s. 6d. per lb. (list price).

Potass. Citrate.—B.P., 1s. 8d. per lb. for 28-lb. lots.

Potass. Iodide, B.P.—13s.—15s. 6d. per lb., according to quantity.

Sod. Citrate, B.P.C., 1911, 1s. 5d. per lb. B.P.C., 1932, and U.S.P.—1s. 9d. per lb. for 28-lb. lots.

Sodium Iodide, B.P.—14s.—17s. 1d. per lb.

GENERAL NOTES

Official Trade Intelligence

The *Department of Overseas Trade (Development and* Intelligence), 35, Old Queen Street, London, S.W.1, has received the following inquiries for British goods. British firms may obtain further information by applying to the Department and stating the specific number. *Canada:* Air compressors (243). *Lithuania:* Tin (G.X. 12,275). *Norway:* Equipment for supply of paper and pulp industry (263); Iron and steel for shipbuilding industry (264); Zinc white, ground chalk for technical purposes (267).

Import Duties Advisory Committee

The Import Duties Advisory Committee gives notice of applications for an increase in the duty on (*a*) patent, varnished, japanned, and enamelled leather; (*b*) bleached cotton linters. Any representations in regard to these applications should be addressed to the secretary, Import Duties Advisory Committee, Caxton House (West Block), Tothill Street, London, S.W.1, not later than March 6, 1933.

An Efficient Grinding and Crushing Service

The crushing and grinding of chemicals and products of similar nature constitutes an important section of the business conducted by Thomas Hill-Jones, Ltd., at Invicta Works, Bow Common Lane, London, E.3. This firm was established in 1830, and has always adopted the policy of keeping its works equipped with the latest and most efficient type of grinding machinery. It was, indeed, the first firm to substitute modern steel

[illegible] old type stone mills. Its present equipment is sufficiently wide and varied to handle all classes of material, either in quantities of thousands of tons for meeting the requirements of large contracts or small parcels intended for experimental use. Three acres of wharf and warehouses are available at Bow Bridge Works for the landing and storage of material and a large fleet of lorries and river craft is available for transport purposes. The works' chemical manufactures include charcoal, manganese, decolorising carbon and bitumen for road-making.

Philips' Sodium Lamp

A simple form of lamp for laboratory use, in which a glow discharge takes place in sodium vapour, is manufactured by Philips Industrial, 145, Charing Cross Road, London, W.C.2. The lamp should be valuable in the laboratory for those applications in which an intense monochromatic source of light is needed, *e.g.*, photometric comparisons in calorimetry, and chemical analysis involving determinations of rotation of the plane of polarization. The principal radiation is from the yellow sodium doublet. Other radiations together have less than 1% of the strength of the yellow sodium lines. If so desired some very weak green and blue lines can be filtered away by either a photographic yellow filter or by a potassium-bichromate cell.

To operate the lamp (215—230 a.c. only) a Philips' rectifier (327) is used. This rectifier supplies heating current to the filament and also provides the necessary voltage for the glow discharge. The lamp is connected to the valve plug of the rectifier by means of a 4-core lead with a 4-pin plug. The primary of the rectifier is directly connected to the mains. To start the discharge, it is only necessary to close the primary circuit of the rectifier by connecting it to the a.c. mains. The Dewar flask is placed over the lamp, and ensures an even, steady working temperature. The lamp reaches full brightness in about 10 minutes after switching on.

Rubber Latex

During the last few years considerable interest has been shown in rubber latex. It has been demonstrated to possess a number of advantages over rubber solutions for important operations, and it seems probable that the next few years will see considerable further development in its applications. Particular interest therefore attaches to the issue of the second edition of "Rubber Latex" by the Rubber Growers' Association, 2—4 Idol Lane, Eastcheap, E.C.3, and any workers who are thinking of undertaking investigations with latex will be well advised to obtain a copy (free) from the Association. It is four years since the first edition was issued and much of the text had necessarily to be re-written by the authors, Dr. H. P. Stevens and Mr. W. H. Stevens. The early chapters deal with the properties and composition of latex, its stabilization, coagulation, manipulation and compounding. The chapters of principal interest are those dealing with manufactures from latex and the applications covering a very wide range, to which it is now being put. One of the book's most useful sections is that giving a list of selected British patents dealing with the utilization of latex, and a valuable bibliography of books and articles which have appeared on the subject is included.

Degussa Gas-heated Furnaces

A further development of the "Degussa" high-temperature furnaces is described in a leaflet recently issued by Bush, Beach & Gent, Ltd. of Marlow House, Lloyd's Avenue, E.C.3, which deals with the "Lilliput" gas-heated high-temperature furnace. This is intended to meet the requirements of those who make only relatively small melting on firing tests. It has been mainly constructed on the principles employed in the company's well-known "Degussa" high-temperature furnaces, *i.e.*, surface combustion in contact-tubes possessing a highly reactive surface, combined with a minimum of resistance inside the furnace and symmetrical distribution of flame and insulation material, in order to obtain favourable thermic conditions. With this laboratory high-temperature furnace 1850° C. can be reached with certainty. Conditions being favourable, a maximum temperature of 1900° C. can be reached. It should be invaluable in smelting and metallurgical works, in glass, cement, and enamel works, and the ceramic industry.

PUBLICATIONS RECEIVED

Traité de Chimie Minérale. Edited by Prof. P. Pascal. Vol. IV. Antimoine-Bismuth-Vanadium-Niobium-Tantale-Bore. Pp. XXIII + 630. Paris: Masson et Cie. 1933. 120 fr.

Methods of Cellulose Chemistry: Including Methods for the Investigation of the Compound Celluloses. By C. Dorée, M.A., D.Sc. Pp. x + 499. London: Chapman & Hall, Ltd., 1933. 21s.

Stereochemie: Eine Zusammenfassung der Ergebnisse, Grundlagen und Probleme. Edited by K. Freudenberg. No. 7. Pp. 959—1116. Leipzig and Vienna: F. Deuticke, 1933. 18 m.

Significance of Phosphoric Esters in Metabolism. By R. Robison, Ph.D., D.Sc., F.R.S. Pp. ix + 104. New York: The New York University Press; London: H. Milford, Oxford University Press, 1932. 11s. 6d.

British Chemicals and their Manufacturers. The Official Directory of the Association of British Chemical Manufacturers, 1933. Pp. 429. London: Association of British Chemical Manufacturers, 1933.

British Chemical Plant Manufacturers' Association. Official Directory of Members, 1933. Pp. 173. London: British Chemical Plant Manufacturers' Association, 1933.

Organic Reagents for Metals. By the Staff of the Research Laboratory of Hopkin & Williams, Ltd. Pp. 60. London: Hopkin & Williams, Ltd., 1933. 1s.

Practical Microscopical Metallography. By R. H. Greaves, D.Sc., and H. Wrighton. 2nd ed., revised and enlarged. Pp. xi + 256. London: Chapman & Hall, Ltd., 1933. 18s.

Seventh Annual Report of the Pharmaceutical Society of Great Britain: Pharmacological Laboratories. Pp. 23. London: Pharmaceutical Society of Great Britain, 1933.

Physics in Meteorology. By G. C. Simpson, C.B., C.B.E., D.Sc., LL.D., F.R.S. Physics in Industry, Lecture No. 18. Pp. 22. London: Institute of Physics.

Soap: Blue Book and Catalog. 5th ed. Pp. 133. New York: MacNair-Dorland Co., 1933.